HILLSIDE INFILTRATION: PRACTICAL SOLUTION OR SLIPPERY SLOPE?

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REID PROPERTY
INFILTRATION EVALUATION

CASE STUDY

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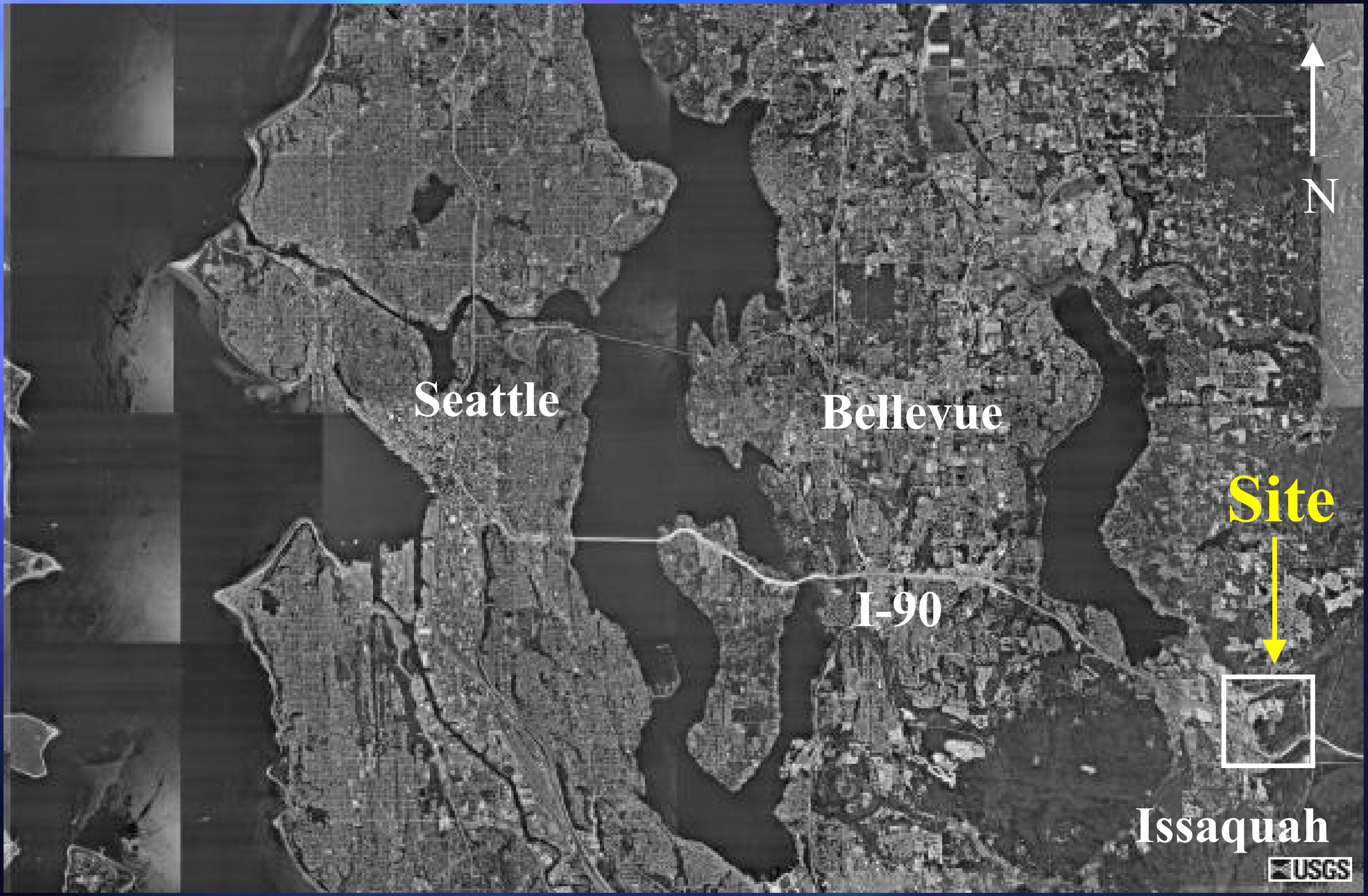
SEATTLE AREA



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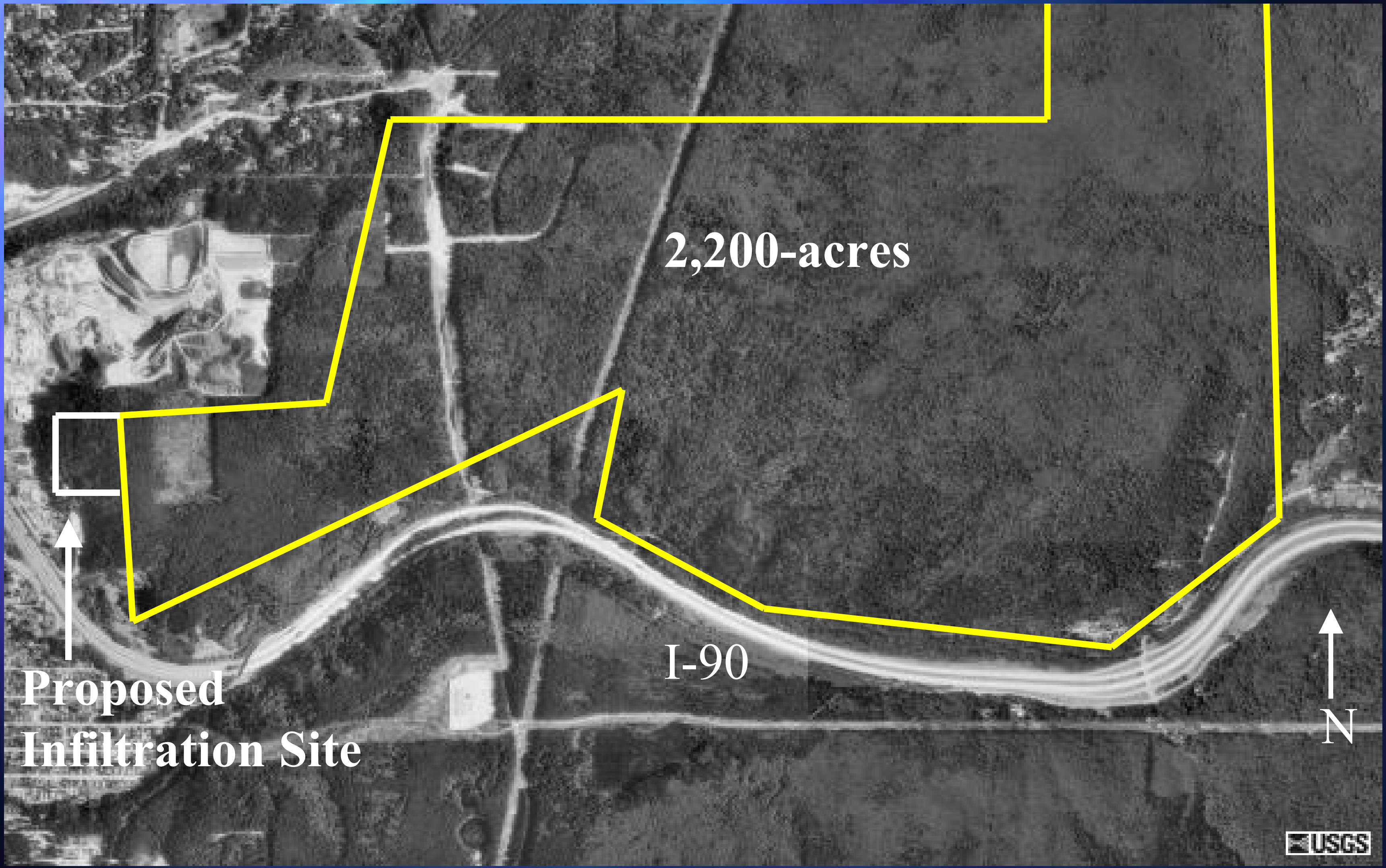
ISSAQUAH HIGHLANDS DEVELOPMENT



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INFILTRATION BENCH

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GOALS AND OBJECTIVES

- Evaluate Whether Dormant Infiltration System Could Accept 6-CFS of Stormwater Without Impacting Slope Stability.
- Evaluate if Ground Water Mounding Would Impact Facilities at the Toe of The Slope

SLOPES AND WATER

- Arrival of Extra Water is the Most Common Event Triggering Slope Failure.
- So is Infiltrating water the Slippery Slope?

LANDSLIDE MODES IN SEATTLE

5 High Bluff Peel off

5 Ground Water Blowout

5 Deep-Seated Landslides

5 Shallow Colluvial (Skin Slide)

P Most Failures are Shallow Colluvial

P Most are Caused by Permeable layer Over Impermeable Layer

THE "RIGHT" CONDITIONS

- 5 **Permeable Soils**
- 5 **Cohesionless Soil**
- 5 **Low Permeability Difference Between Layers**
- 5 **Expensive Land to Make Additional Work Justifiable**

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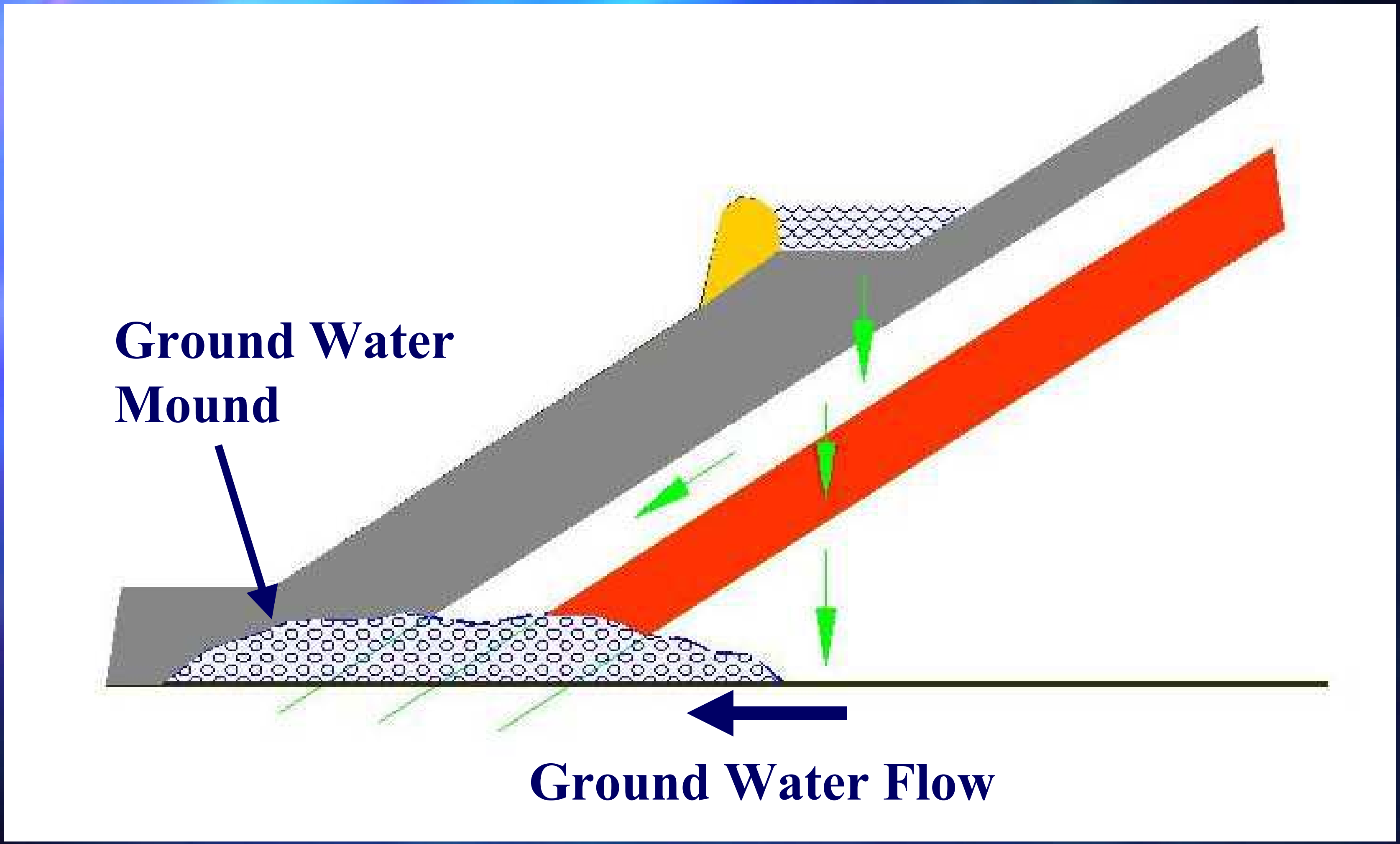
GROUND WATER MOUNDING



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PHASED GO-NO GO APPROACH

5 Review Available Geology and Hydrogeology Data.

5 Conduct Preliminary Field Evaluation.

  3 Detailed Field Mapping.

  3 Test Pits, Borings, Monitoring Wells.

  3 Grain Size Analyses.

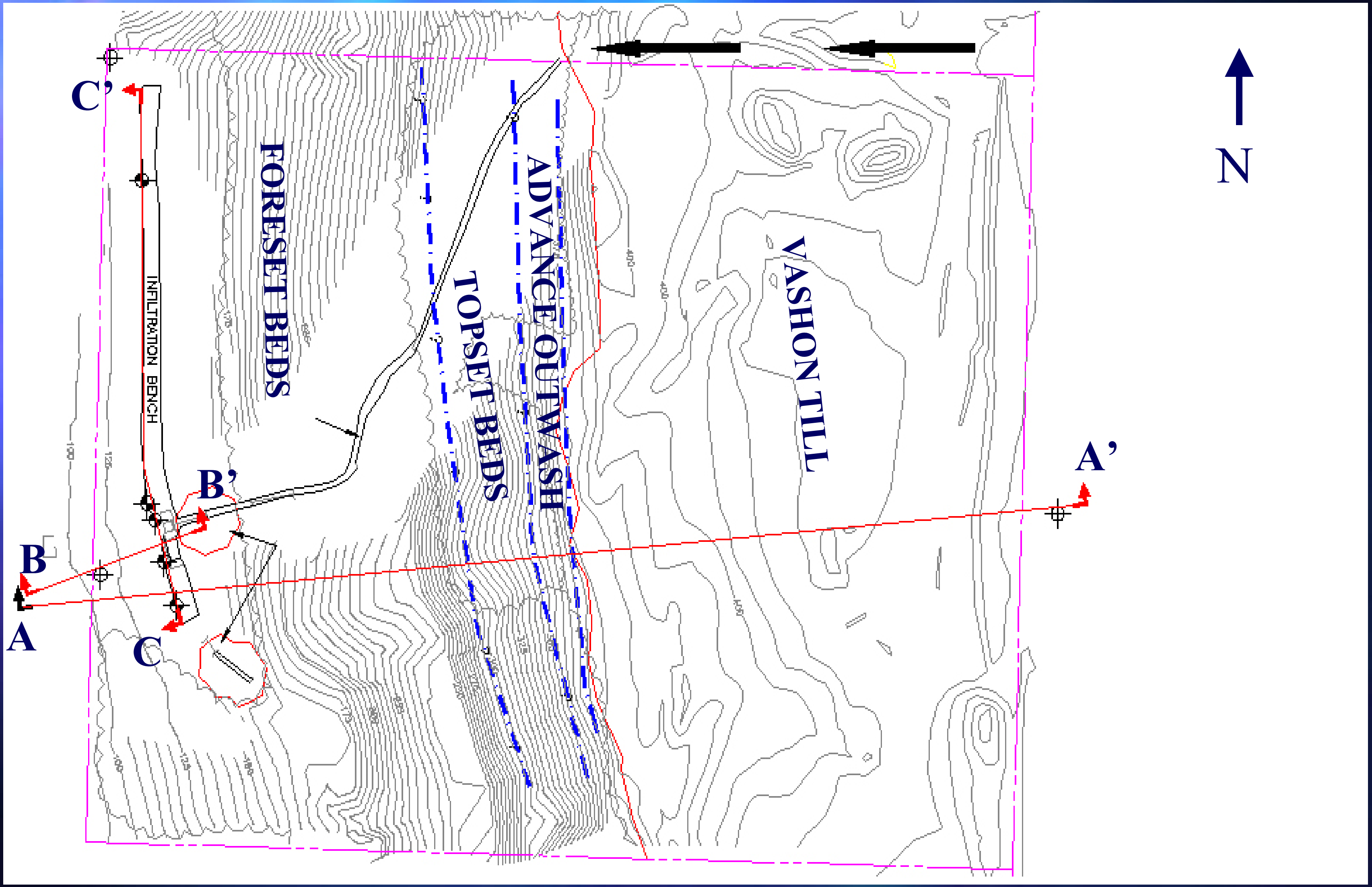
5 Conduct Small-Scale Pilot Infiltration Tests (PIT).

  3 Monitor Field Parameters (ground water level, etc.)

5 Conduct Large Scale Infiltration Test.

5 Perform GW Mounding and Slope Stability Analysis.

GEOLOGIC MAP



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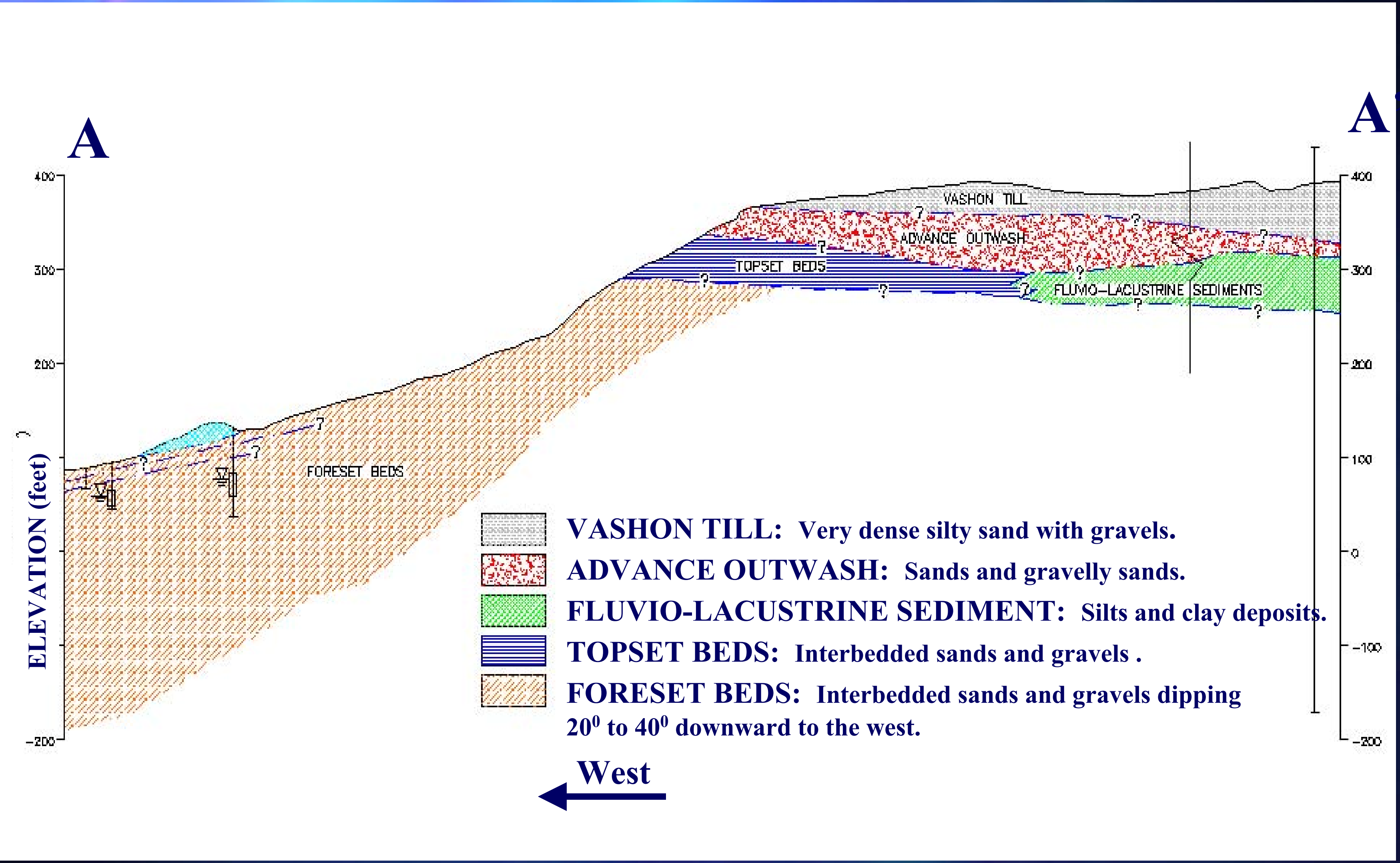
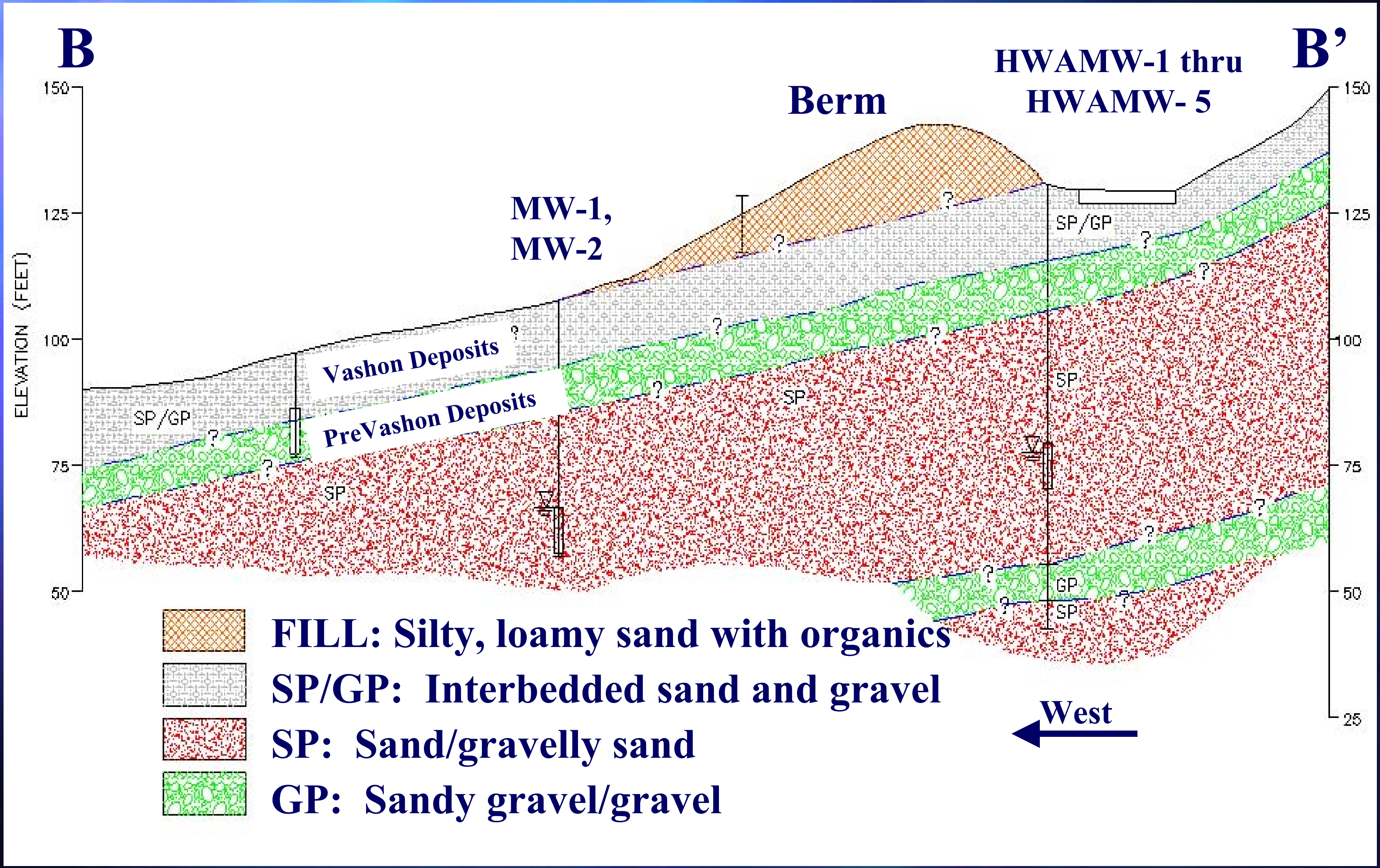
CROSS SECTION A - A'



CROSS SECTION B - B'



CHALLENGES

- Find a Sustainable Source of Water to Conduct the Large Scale Infiltration Test at 6-CFS (2,700 GPM).
- Monitor Infiltration Test to Prevent Hillslope Failure and damage to adjacent structures.

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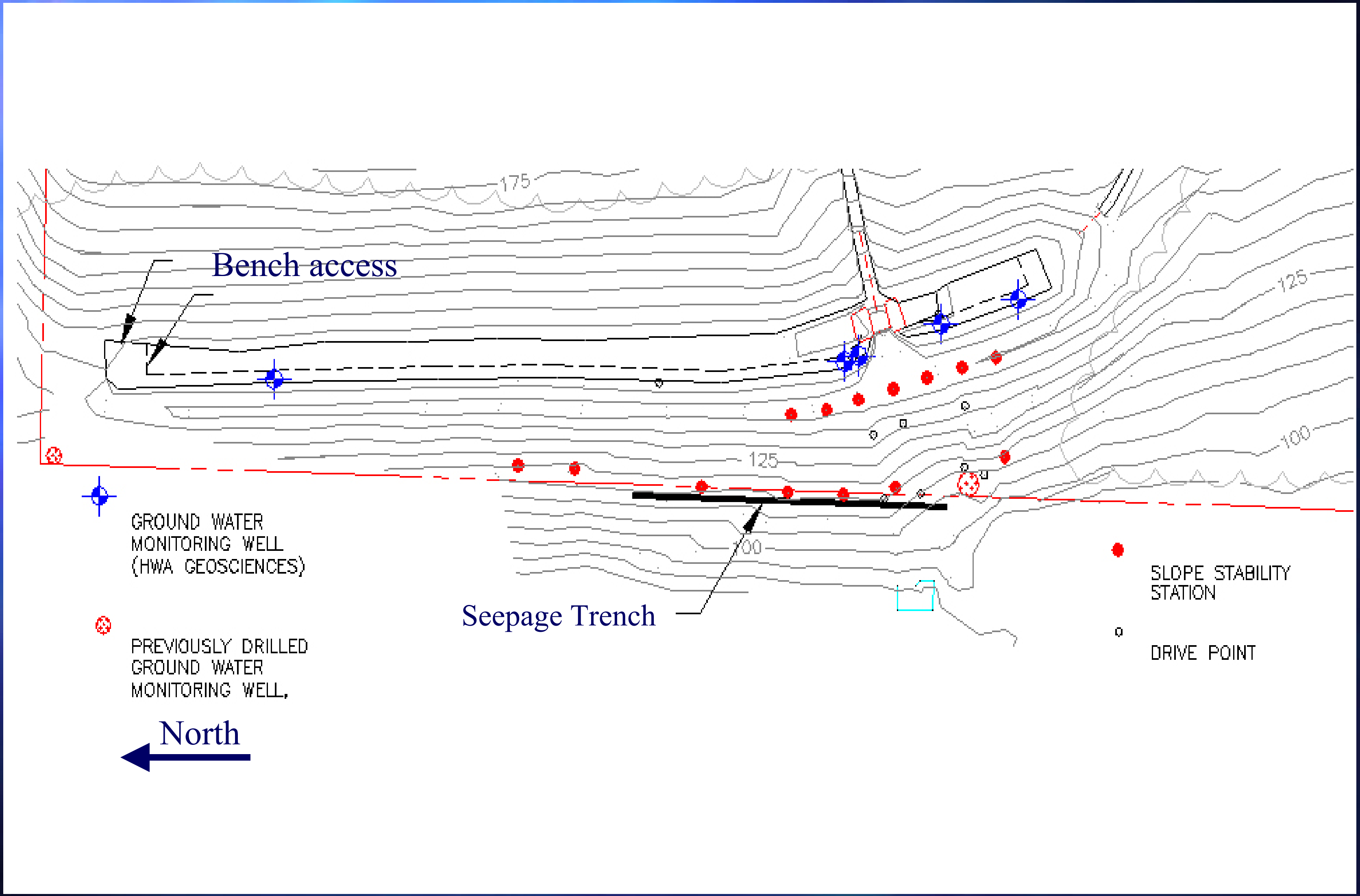
INSTRUMENTATION



BASE OF BENCH SLOPE

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INFILTRATION BENCH INTERBEDDING

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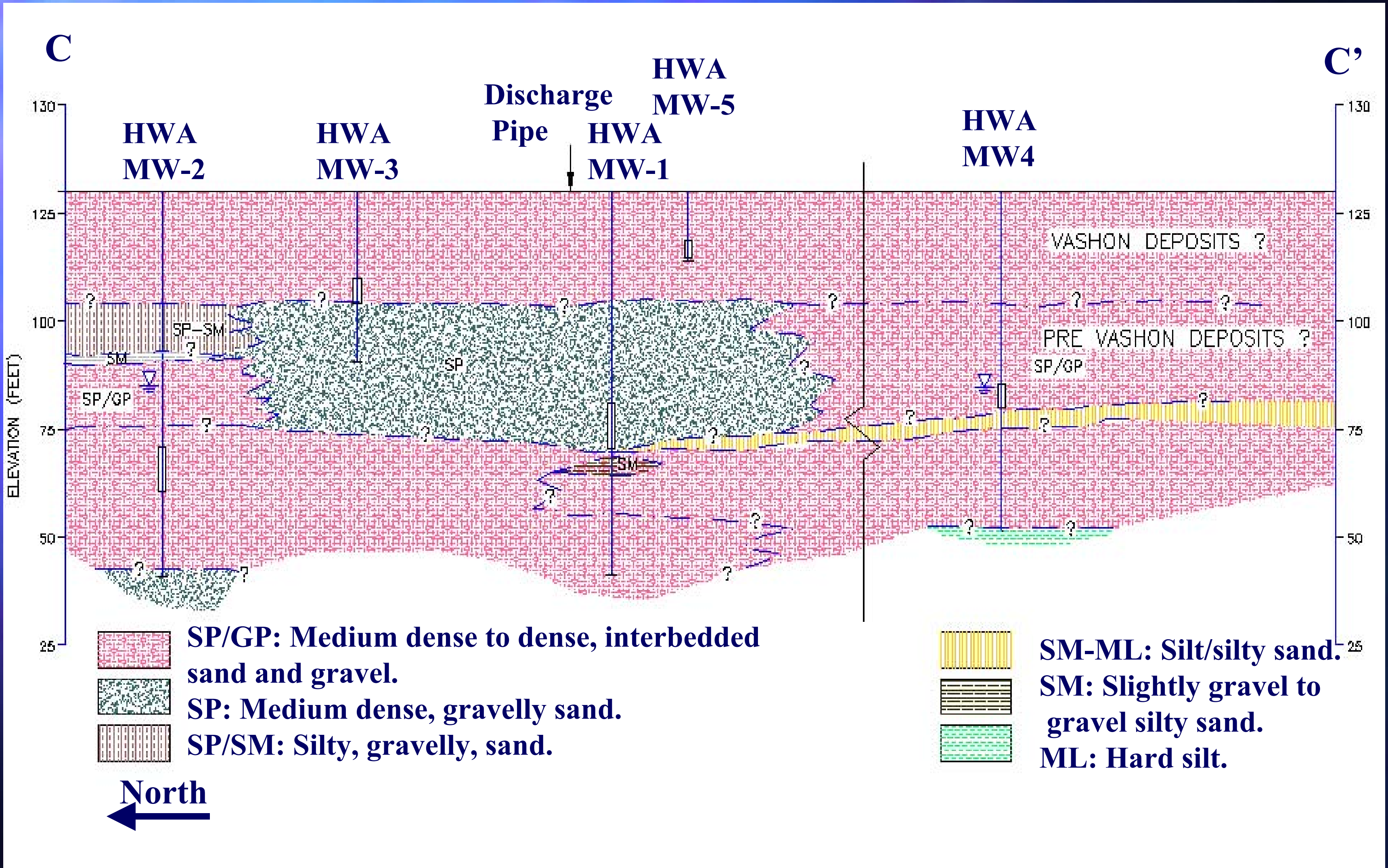
CROSS SECTION C - C'



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WATER DISCHARGE DISSIPATER

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DISCHARGE FLOW DISSIPATER

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DISCHARGE FLOW TO DISSIPATER

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FULL-SCALE INFILTRATION TEST RESULTS

5 **Infiltration Rate**

5 **GW Mounding**

5 **Slope Stability**

SUMMARY of DISCHARGE FLOW and INFILTRATION RATES

Time (hours)	Water Depth (feet)	Flow Rate (CFS)	Infiltration Rate (inches/hour
5.5	0.3 to 0.7	3.7	52
13.5	0.4 to 0.7	5.4	62
3	0.4 to 0.7	6.6	75

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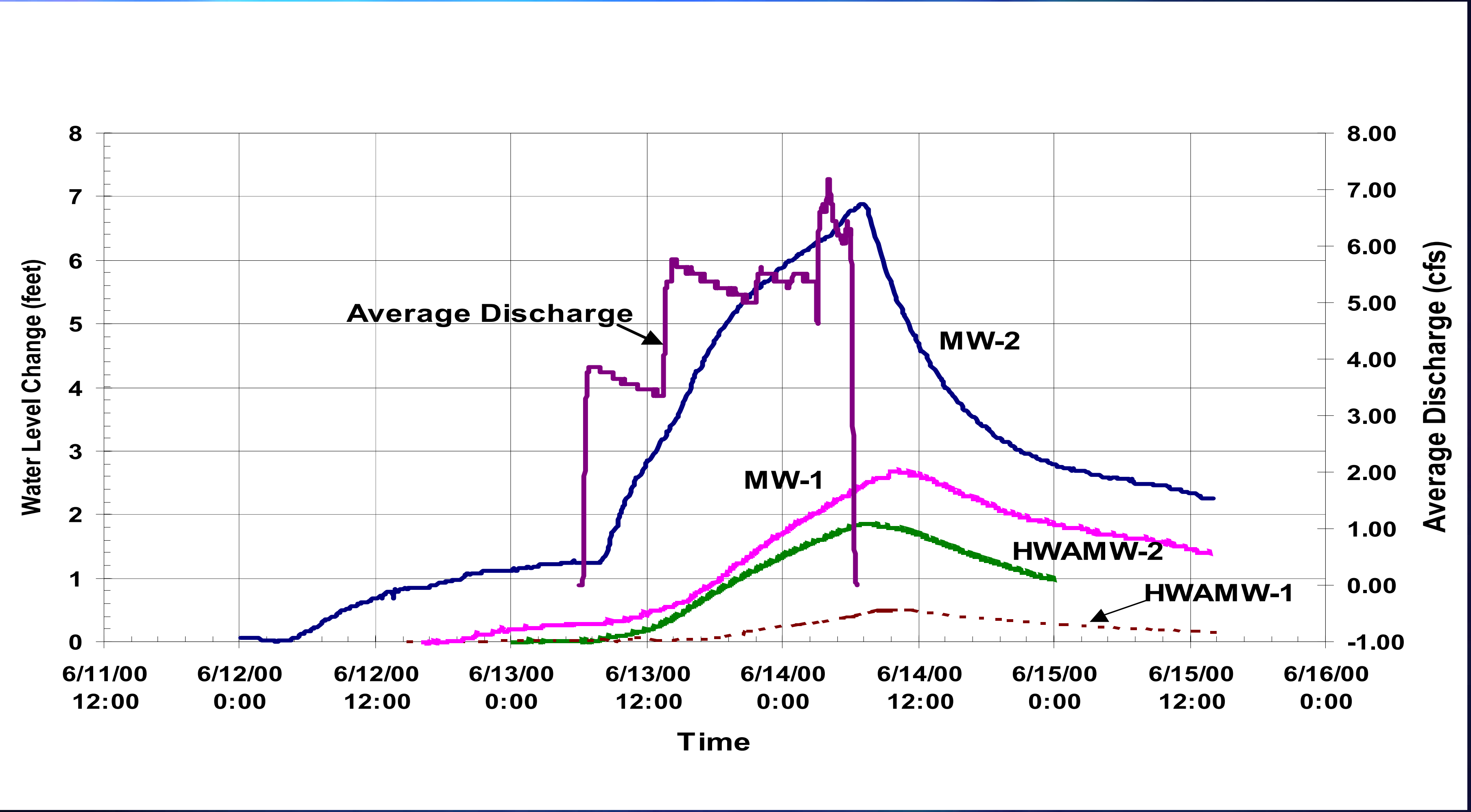
24-HOUR INFILTRATION TEST
GW Levels and Average Discharge



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SLOPE STABILITY

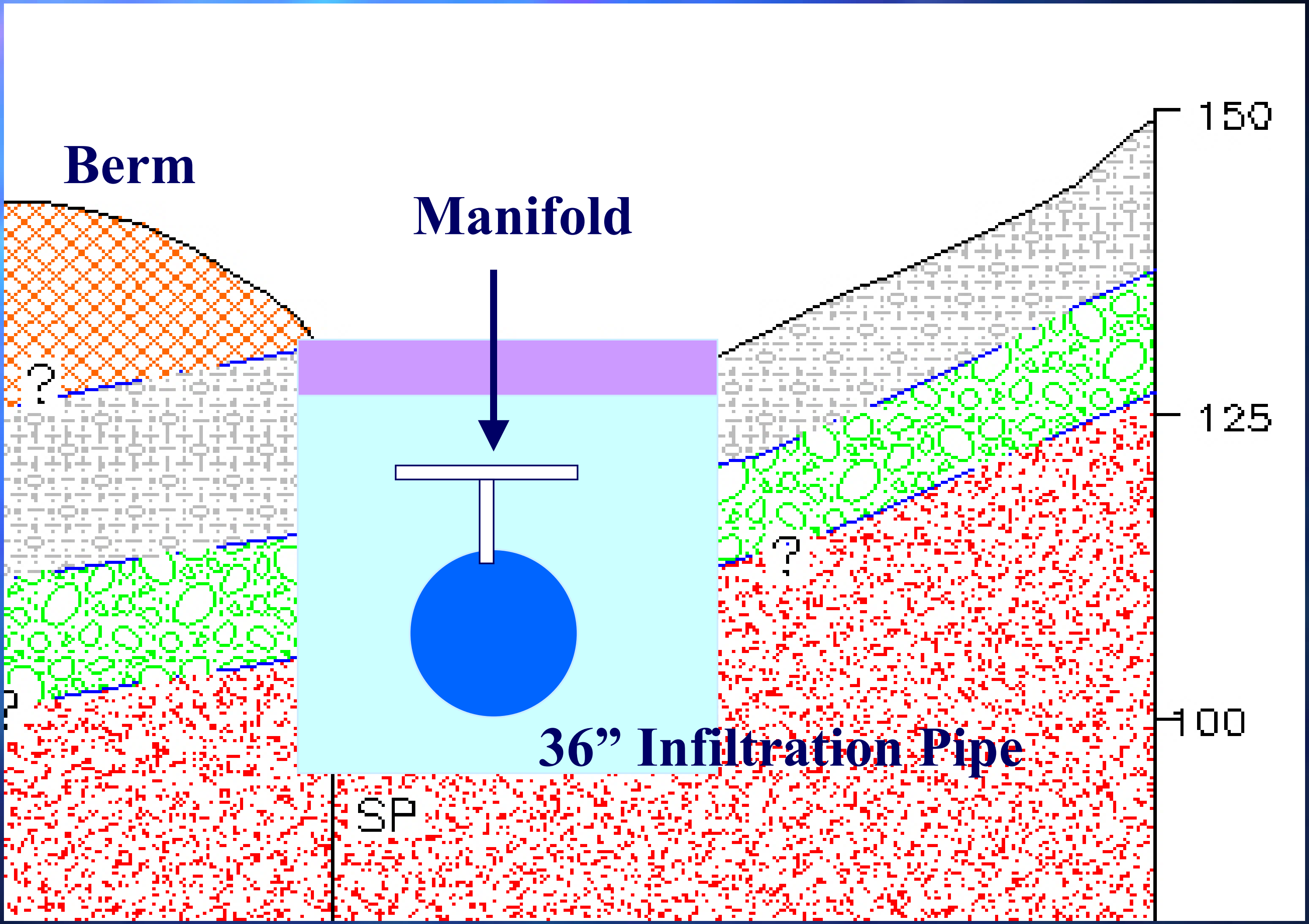
5 **Analyses using the Piezometer Monitoring Data.**

5 **Minimum Factor of Safety was 1.8.**

KEY RESULTS

- Water Ponded in Infiltration trench to 0.7 feet.
- Preferential Interbedded Flow.
- No Seepage Breakout.
- No Slope Movement.

INFILTRATION FACILITY



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CONCLUSIONS

5 HILLSLOPE INFILTRATION NOT NECESSARILY SLIPPERY SLOPE

5 "Right" Hydrogeological Conditions

5 Detailed Phased Investigation

5 Full-scale Infiltration Testing

5 Proper Infiltration Facility Design

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INFILTRATION TEST

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